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LIGHTING DATA

EDISON LAMP WORKS
OF GENERAL ELECTRIC COMPANY

GENERAL SALES OFFICE

HARRISON, N. J.

Ship Lighting



Information compiled by

R. W. PEDEN

Lighting Service Department

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Introductory

Ship lighting is indeed an interesting and broad subject, for the modern passenger vessel is virtually a small town with diversified lighting demands just as found on the shore, that is, on board ship one finds dining, smoking, music, lounging, reading and writing rooms, barber shops, gymnasium, swimming pools, roof gardens, store rooms, machine shops, power houses and the like. On land each of these is treated as a separate subject, yet the broad term, ship lighting, covers them all.



FIG. 1

View of the Lounge on One of the Largest Ocean Liners with Massive Ornamental Fixtures of Crystal Glass. The magnitude of the installation on ship-board is greater than ordinarily believed, for example, there are 10,000 lamp sockets in use on the S.S. *Olympic*

The problem is further complicated by the fact that there is a minimum of space available for hanging fixtures. There are no walls in which to conceal the wiring, and in the majority of cases it is impossible to take advantage of many of the methods of installation which are used on land and which add much to the appearance of the system in general.

It is outside of the province of this article to trace the history and developments of methods of ship illumination. Previous to the invention of the incandescent lamp, flame light sources of various types were employed for artificial illumination. The inherent advantages of electricity from the standpoint of safety, compactness and convenience of control for ship lighting were at once recognized and it is interesting to note that the steamship *Columbia*, built at Chester, Pa., 1879, was sent to New York City in 1880 to be fitted with the first Edison incandescent lighting plant that was ever installed for commercial use. The original methods of application were indeed crude compared with our present-day standards. With the increasing appreciation of the artistic element of lighting and knowledge of methods of applying it, ship lighting has advanced by rapid strides until, on the ocean greyhound of the present day, we find installations of decorative lighting which are comparable with the best practice in artistic buildings.

The decorative feature of ship lighting has advanced more than utility lighting. This is parallel with other experience. Industrial lighting, for example, has been long neglected, glaring inefficient sources were employed. Within the last few years there has been a decided revival of interest in this subject and the modern industrial plant is well on the way toward effective lighting. Plant managers have realized that increased production, greater safety, more cheerful working conditions, improved sanitation are all features dependent upon high level lighting. The day is not far distant when those having authority over ships will realize these advantages. The lighting of the working parts of the ship offers the greatest opportunity for improvements.

Special Requirements as to Wiring

Escape from a ship at sea is always accompanied by considerable hazard and it is most essential that the possibilities of fire be reduced to a minimum; hence, we find that insurance companies, underwriters, and ship owners themselves are very careful to specify a high grade wiring system with suitable fittings. An examination of the fire underwriters' requirements for generators and wiring aboard ship shows them to be more stringent than the most exacting land rules.

A failure of the lighting system at a critical time in any public building is likely to cause panic, therefore, special precautions in the way of supplying duplicate generating equipment are taken, for

instance, ships, such as the *Olympia*, *Aquitania*, and *Mauretania* have four generating units. Both turbo-generators and vertical reciprocating engines are used as prime movers. The capacity of a generator ranges from one kilowatt on small vessels up to 400 kilowatts on large ocean liners.

The advantages in the way of strength and reliability of the 110-volt lamps have been generally recognized and three-wire, 220-volt or two-wire, 110-volt distributing systems are employed. In the best installations, the power and lighting circuits are separate.



FIG. 2

Night View of a Social Hall Lighted by Diffusing Ceiling Fixtures with Silk Shaded Candle Type Wall Brackets. A cheerful homelike appearance is created

The protection of feeders is one of the most important considerations in the wiring of a vessel. Preservation of life of the traveling public and continuity of service both depend upon it. As previously stated, modern rules in this country demand metallic protection for all feeders but in many of the vessels built abroad lead covered wires are used in the passenger quarters or where mechanical injury is not likely to occur. However, approved conduits give the best protection when installed with water-tight fittings. This is espe-

cially true in the case of cargo spaces. Here it often happens that during the process of loading and unloading pipes are wrenched from the deck and in extreme cases cut off entirely. To this fact must be attributed the general absence of permanent lighting in the hold or on the freight decks.

Wood molding, although widely used in the vessels of the older type and still to be found on them, offers but little protection and on account of this, in addition to the fire risk, should be avoided.

Special Requirements as to Fixtures

The electric fittings used on board ship must be of strong, substantial design, sufficiently rigid to withstand the motion of the vessel. In general, the low headroom makes it necessary that they be short. There are three general classes of fixtures to be found on the modern vessel: (a) Special ornamental or decorative fittings for the salon, music hall, smoking room, first class dining room and the like. These are of the same general type used on land, except that they must be of especially sturdy design. (b) Utility type fixtures, such as are employed in the general state rooms, passageways and similar parts of the boat. These correspond to the commercial type of fixtures used where special attention is not paid to artistic results in an office building or hotel, bearing in mind the qualifications as outlined as to dimensions and structure. (c) Water-tight fittings such as are necessary in the engine room, open deck and other parts of the vessel exposed to the elements.

The essential parts of a water-tight fixture are a cast-iron or steel fitting, into which a glass enclosing globe may be screwed and a rubber gasket placed between the metal and glass. The metal fitting is attached to the conduit or may be fastened to a water-tight pull box. A number of types of enclosing globes are employed: a cylindrical globe from three to four inches in diameter, a flatter type known as a bulkhead light, and cattle deck lights which are used on the decks devoted to freight. Most water-tight fittings are so constructed as to make possible the attachment of a wire guard for protection of the globe from mechanical injury. Clear MAZDA lamps are usually employed, although in many instances frosted or enameled lamps are desirable on account of the added diffusion. Reflectors are rarely used, although they can be satisfactorily accommodated to this type of fitting and their use would prove of value in many instances as indicated later.

Lighting Practice and Requirements

Salon, Writing Room or Library, Smoking Room

The decorative element of lighting is predominant here in common with similar spaces on land. If space permits, massive ornamental ornate fixtures are employed, often of special design as indicated in Fig. 1. No set rules can be laid down for lighting of this nature as the keynote of an artistic installation is originality, but whatever system is employed should be such as to make the room



FIG. 3

A First Class Drawing Room Where Harmony of Lighting and Room Decoration Prevail. It is interesting to note the careful attention to detail of wall fixtures and silk shaded desk lights. A moderate intensity of general illumination is provided by close ceiling units

comfortable. Bright light sources, particularly against dark backgrounds, are glaring and annoying. An average intensity in the neighborhood of two or three foot-candles is adequate for the purposes for which these portions of the ship are used. As in many examples of ornamental lighting, the fixtures are relatively inefficient from the standpoint of utilization. This fact must be given consideration and a sufficient wattage employed to produce the desirable illumination.

Where the ceilings are low as indicated in Fig. 2, it is necessary to employ a number of smaller units to get a desirable distribution of light.

The warm cozy effect necessary when illuminating a room of this character is obtained by the use of a low intensity of general illumination from some form of decorative overhead fixture supplemented by candle stick brackets or sconces with silk shades or other means of shielding the eye from the light source. Tinted or



FIG.

Night View of an Attractive Smoking Room Equipped with Lantern Type Fixtures. The light from three 25-watt MAZDA lamps is diffused by the art glass sides and bottom with dark surroundings such as found here. Particular precautions must be taken to keep the units of low intrinsic brightness

toned lighting is often of service and is coming into use in the more modern installations. Suitably shaded decorative reading lamps on the writing desks give another touch to the installation. A drawing room on a large liner where this general scheme of illumination is followed is pictured in Fig. 3.

Occasionally the surroundings are dark (see Fig. 4) and under these conditions particular attention must be paid to the placement and character of light sources to avoid undue contrast.

Dining Room

The dining room of the modern ocean liner offers conditions quite similar to those of the first class hotel grill room with its low ceiling. It is fortunate, however, that the interior finish on board ship is usually a pure white. Two practices exist as to lighting: (a) The provision of a sufficient intensity of general illumination by means of small rather closely spaced overhead units, or (b) the use of a low intensity of general illumination supplemented by local or table lamps throughout the room. The first practice is pictured



FIG. 5

A First Class Dining Hall with a Moderate Intensity of General Illumination
Supplied by Diffusing Ceiling Units Employing MAZDA C Lamps
Symmetrically Spaced Throughout the Room

in Fig. 5, and the second in Fig. 6. As larger units will be required for the strictly general lighting system, precautions must be taken to diffuse the light by the employment of suitable enclosing globes as indicated in the illustrations referred to. With the other system the use of an ornamented ceiling receptacle with round bulb all frosted or toned MAZDA lamps is satisfactory, for these can be of comparatively low wattage. The above outline, of course, covers merely the fundamental considerations and in common with the

hotel restaurant is subject to an almost infinite variety of modifications. Semi-indirect illumination from ceiling units or floor pedestals, totally indirect illumination from bracket type fixtures or cove lighting have all been employed with excellent results. An example of the utilization of various forms of lighting producing an extremely decorative room is to be seen in Fig. 7. As would be expected the lighting in the second and third class dining rooms is considerably less ornate and the fixtures are of a more utilitarian character.



FIG. 6

The Dining Room on an Ocean Liner Illuminated to a Low Intensity by Close Ceiling Type Units, the General Lighting Being Supplemented by Silk Shaded Table Lamps Supplied from Baseboard and Floor Outlets. This combination proves very effective in promoting an attractive dining salon

State Room

The state room is essentially the bed room of two or more persons. It must at the same time be the lady's boudoir, the gentleman's dressing room, and not uncommonly is it called upon to take the place of the hospital ward. Thus, there are four distinct rooms in one which seldom occupies a space greater than 8 by 8 by 7 ft. Despite the minimum space available, the traveling public demands the same conveniences on shipboard as are found

on land under similar conditions, that is, the bed room must have good general illumination supplemented by reading lamps at the heads of the beds. The boudoir must be so lighted as to produce a warm and cozy effect, at the same time supplying ample illumination on the dressing table. The men's dressing room requires good illumination at the mirror for shaving, while the hospital ward calls for a subdued light which will add to the comfort of the patients and yet permit the nurse or attendant to move about with facility.

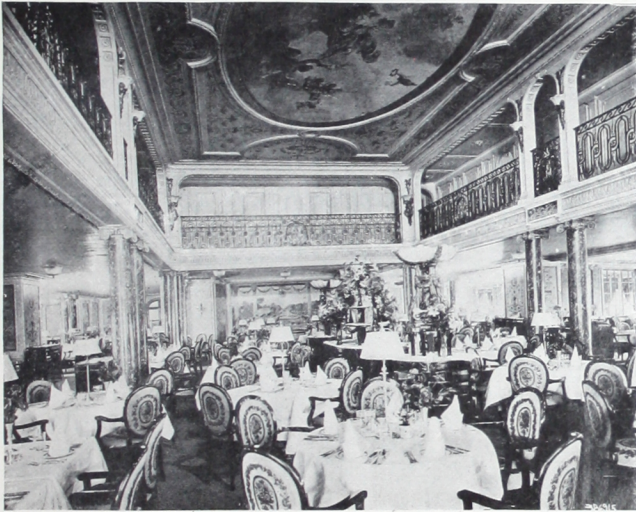


FIG. 7

A Splendid Example of Decorative Dining Salon Lighting Found on the S. S. *Aquitania*. Huge ornate urn shaped pedestals with translucent glassware and similar wall brackets furnish general illumination for the main portion of the room, at the same time illuminating the beautifully decorated ceiling. Small diffusing ceiling fixtures are used beneath the balcony for general lighting. Carefully designed silk shaded table lamps are used throughout

It is obviously impossible to meet all the above requirements in the most effective manner in the space available and, as a result, in many instances very little consideration has been given to the lighting of the state room. Fortunately, the surroundings are invariably painted white, which condition gives good diffusion and relatively high utilization of light. More comfortable conditions are produced when the finish is matt or flat, rather than glossy. The view shown

in Fig. 8 is fairly typical of the average installation. A single unit consisting of a very simple type of ceiling receptacle with a round bulb all frosted MAZDA lamp is placed in the center of the open space. Above the wash bowl will be noticed an auxiliary unit. In this particular instance, no special lighting is provided for the beds, and the installation is not particularly decorative.

In some of the more recent installations, in the first class state rooms of the modern ocean liners, very elaborate systems are in use. Here the rooms are somewhat larger, 12 by 12 by 7 ft., and the berths often in the form of narrow beds. General illumination is supplied by one or more overhead units, occasionally localized with reference to the beds. They are invariably close to the under side of the deck, but frequently diffusing media in the form of opalescent glass bowls are employed. Silk shaded reading lamps over the head of each berth or bed add to the comfort of one passenger without disturbing the others. Special outlets are often provided over the mirror or dressing table, while on the bulkhead and partitions between the rooms silk shaded candelabra brackets with tinted lamps supply a subdued and warm effect in case of sickness. Such an installation is very satisfactory and illustrates what an important adjunct proper lighting is to the comfort and convenience of the traveling public. An example of the application of these principles is pictured in Fig. 9.

To a certain degree, the question of lighting is purely one of economics as in hotel practice. The public when paying a top price expect all the comforts possible. Where a lower price is charged, less elaborate equipment will be found. The very first grade state room would probably have lighting of the type described in the preceding paragraph, the second grade, much less elaborate, while the third grade, an overhead unit of the most simple and inexpensive type becomes the sole source of light for the state room housing from two to six passengers. Even under these conditions, sufficient light must be provided to enable one to find his way about the room and make his toilet with comparative ease.

Working Areas

The working areas on board ship may be compared to the controller on a large motor. The construction of the motor may be excellent, but so long as the power which it is capable of producing is not adequately under control, it cannot give satisfaction. The same is true of the "working areas" in a ship with regard to the efficient handling of the vessel. These areas are really the life-

giving centers, and the whole mechanism, financial and otherwise, which goes to make up a shipping company, must vibrate in rhythm or in synchronism with these centers. On the other hand, each separate department of the so-called working areas must operate in harmony with one another. That is, the engine room area can not respond with alacrity to the orders from the bridge if the conditions in the boiler or fire room are such as to render the steam pressure uncertain. On the other hand, the firemen must depend upon the "coal passers." As for the galley, or kitchen, the physical fitness of the crew in general largely depends upon it and in order

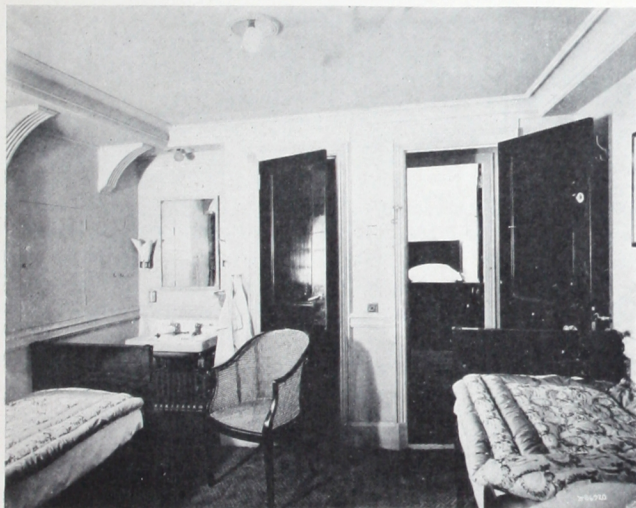


FIG. 8

A Typical State Room Lighting Installation, One Central Ceiling Fixture
Employing a Round Bulb all Frosted MAZDA B Lamp with
an Auxiliary Unit Over the Wash Bowl

to meet this most important requirement, the galley and its operating force must be highly efficient. Thus, throughout the entire working areas (in which may be included the entire quarters of the crew to say nothing of their dining and recreation rooms as well as the barber shops, stores, freight spaces, offices, etc.), this interlocking system is found. The failing of any one department is equal to the smashing of an important gear in a driving machine and is felt throughout the entire organization.

While realizing the importance of this aspect of the shipping question, private companies have not subjected the situation to very careful investigation. However, the United States Navy has conducted certain scientific researches along these lines with very satisfactory results. One of the more important points brought out is the physiological effect of proper and adequate lighting on the crew and consequently on the handling of the ship in general. In other words, if a man is to do his best, he must be kept in a cheerful mood, he must have confidence in himself, in the company for which he works and must feel that he is an important part of a great and worthy organization. He must feel that his employer is interested in him as an individual and not merely as a chattel which may be used for the production of dividends. It has been shown by actual investigation that good illumination goes a long way toward the accomplishment of these ends. It gives the surroundings a cheerful appearance, thereby keeping the crew in a happy frame of mind—other circumstances being favorable—prevents each man from dwelling upon his imaginary troubles and creates a spirit of fraternity throughout the organization. Other advantages of good illumination are prevention of accidents from inability to see clearly, allowing the crew to move around quickly, easily, and with confidence. This makes possible and insures the proper and rapid loading of the vessel, thus economizing time at the dock and preventing the shifting of cargo when at sea. It is a great aid from a sanitary point of view and assists materially in making repairs.

Engine and Fire Room

It is very difficult to properly illuminate such spaces as these on account of the unsystematic arrangement of the multitude of overhead pipes, beams, and deck supports. The situation is very similar to that of a modern engine room or power house on land. However, the same floor space is not available and the headroom is often less than one third of that found on land. The surroundings, too, instead of being white are often dark and unattractive. However, just as on land, an equal intensity is required over the entire floor or deck space with a higher intensity at important points. This is often impossible in the engine and fire room on board ship, but great care must be taken to avoid dense shadows in the passageways around the engines, etc.

It is frequently necessary to make repairs when at sea or under other circumstances where time is a valuable asset and since a high intensity of light is thus temporarily rendered essential, numerous outlets for auxiliary units must be provided.

The type of fixture used in engine and boiler spaces on board ship varies widely from that used on land, but the modern lighting system is somewhat similar. The law requires that only vapor-proof fixtures shall be used. Actual practice for many years, while complying with this law, shows marked neglect in the majority of other details. The units generally consist of clear MAZDA B lamps placed within an enclosing globe so as to render the completed fixture moisture-proof. These units are installed unsystematically at any convenient hanging height and at any place where illumination seems to be most necessary. The outer globes are generally of clear glass and since the units are frequently quite low, glare always results. In many cases the unit itself is directly in the line of vision, being placed too near the object which it is intended to illuminate. On the whole, these old installations are very inefficient, render vision uncertain and difficult and present a somewhat gloomy appearance, the contrast between the bright light sources and the proverbially dark surroundings being very marked.

In modern installations, however, the systems are on parallel with those on land under similar conditions. The type of fixture is materially the same but the addition of suitable reflectors and diffusing mediums adds to the effectiveness of the entire system. Fig. 10 shows a typical modern installation for engine room, fire room, auxiliary engine spaces, etc. In this view white glass diffusing outer globes are used, but in one fixture it will be noted that an enamel steel reflector has also been added. Here the system would suggest that known on land as localized—general illumination. This system, just as on land, has proven very satisfactory. It allows the crew to move around with ease and confidence, eliminates glare and when supplemented with units, provided with proper reflectors, over indicators, etc., is to be highly recommended. As here shown, it demonstrates the great possibilities of high power units—hitherto unknown in these parts of a vessel.

Galleys

The galley is what the landsman would call the kitchen. On large ocean liners it closely resembles in many respects the kitchen of a modern hotel. Here again, available space is reduced to a minimum and, unlike the hotel kitchen, the headroom in a galley seldom exceeds eight feet. The finish is generally white, but the location eliminates the chance for good daylight illumination, thus rendering artificial illumination absolutely essential. In the galley, light is essential for two purposes: first, to enable the cooks and

other attendants to prepare the meals with sanitation and ease; and second, to supply a light of sufficient intensity to impart confidence to the stewards as they move around with loaded trays and to insure the rapid loading and handling of supplies. In the galley-stores all that is required is a good general illumination to make objects easily distinguishable in any part of the store.

Since the benches, tables and cooking ranges serve as the boundaries of the various passages, good results may be obtained by installing a sufficient number of units over the former. Fig. 11



FIG. 9

Suite De Luxe with General Illumination from Cut Crystal Ceiling Fixtures. Localized lighting over the beds, dressing table and wash bowl is provided by 25-watt MAZDA lamps in silk diffusing shades. Elaborately ornamented brackets serve to support these units

shows an installation of this nature. Vapor-proof fixtures should always be employed. One hundred-watt MAZDA C lamps, all frosted or in opalescent globes on centers from eight to ten feet, are satisfactory, although if structural considerations are such as to render this arrangement inadvisable smaller lamps on closer spacing should be employed. Since the ceiling is usually a pure white, reflectors are not as essential here as in many other areas. The glaring clear lamp and clear globe should always be avoided.

Lighting units placed close to the ceiling are desirable rather than low hung, for the likelihood of annoying glare and accidental breakage is thus diminished.

Freight Decks

From the point of view of the illuminating engineer, this is practically an untapped field. The majority of modern ships have no permanent artificial light in the freight spaces. There are several reasons for this. There is no fixture on the market today which is rugged enough to withstand the service to which it is here sub-

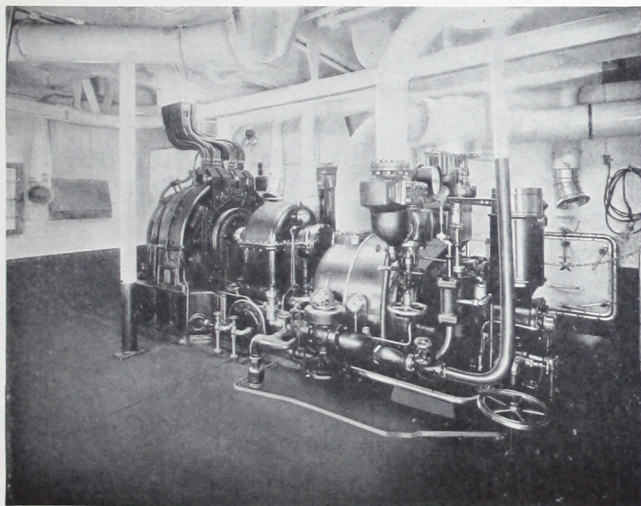


FIG. 10

The Dynamo Room on One of the United States Battleships. It is interesting to note the excellent diffusion produced by the white walls, ceiling and piping.

Contrary to what might be termed "standard practice," reflectors are employed in addition to the vapor-proof enclosing globe

jected, during loading and unloading. The shipping companies and insurance companies fully realize the danger of fire from short circuit when a lamp is smashed or a wire cut in close proximity to inflammable material. The construction of these spaces and the uses to which they are put make it difficult to so conceal the units and wiring as to adequately guard them against injury. It cannot be denied that good illumination is just as essential here, if indeed not more so, as on the piers. The ship must not only be loaded

properly but very often with abnormal speed, hence any system which does not provide a fairly uniform illumination is unsuited. This is not obtainable with a few portable lamps scattered at random. Good illumination will add materially to the speed with which a vessel may be loaded and unloaded, reduce accidents and offer many other advantages which, on land, have been proven to accompany adequate and suitable lighting.

Portable units are now in use in these spaces. These are of the multi-lamp type and employ porcelain enamel reflectors. Some installations provide vapor-proof portable receptacles on each deck at the hatchway. There are generally four of these per hatchway, one at each corner. This is an unsatisfactory arrangement as the portable units are in the way and the conduits are often wrenched from their fastenings.

Speaking of the working areas in general, the absence of good illumination cannot be attributed to economic causes. On land, manufacturers and store keepers have come to realize the value of artificial lighting. Most of these men, or at least a high percentage of them, are forced to buy the power from an independent company, but ship owners of necessity must generate current for their own use and consequently pay a minimum price. Hence, from a supply point of view, the ship owner has the advantage of his brother on land, yet the latter has been much more quick to adopt modern methods in lighting. On the other hand, the initial cost of installation on land is in excess of that on board ship and the fixtures themselves in a great many cases are less expensive in ship lighting than on land. Why then, do so many ship owners persist in their refusal to benefit by the result of recent experiments?

How can these conditions best be remedied? That is a problem which can only be solved by extensive experiment and close co-operation between the fixture manufacturing companies, shipping concerns and insurance authorities. There can be no doubt that an infinitely better system than that in use could be found. It is outside of the province of this article, which merely outlines practice and makes a few suggestions, to discuss this matter in detail here,

Passageways and Decks

The passageway on board ship takes the place of the hall in the modern home. While the latter, however, is frequently used as a reception room, the former is too narrow and too long to be used for any other purpose than that which its name implies. On the modern ocean liner, passageways are so constructed as to allow

two persons to pass each other, yet each passage may serve as the gateway for a hundred or more state rooms. These passages are generally located between two rows of state rooms, hence very little daylight can penetrate to them and artificial light must be used continuously. It is obvious that good illumination must be supplied. A good general illumination meets the requirements at all times, but it is advisable to have some device for increasing the night intensity over that used in the day time.

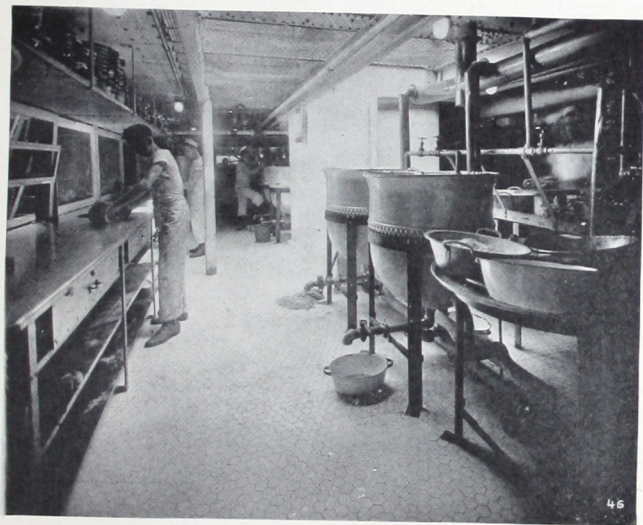


FIG. 11

Localized General Illumination Over a Ship's Galley. Outlets at regular intervals over the benches or tables give the maximum light where most needed and yet provide sufficient spread for the aisles and passageways

In passages leading to and from the crew's and third class passengers' quarters, the plan of illumination generally employed is very simple. Overhead units in the form of simple ceiling receptacles with clear, frosted or bowl frosted MAZDA lamps are employed. There is little or no variation in this class of lighting, but the installation should be such as to allow alternate units to be turned on when it is desired to reinforce the daylight. A spacing distance of 15 to 18 ft. is generally employed and the wattage of the lamps varies from 15 to 40 watts.

In passages leading to first and second class state rooms a diffusing medium is sometimes added to the units as described in the previous paragraph. This installation calls for lamps of higher intensity and shorter spacing distance than that just mentioned. A flat white finish of surroundings gives best results as it reduces glare and gives better diffusion.

The open decks may be compared to the sidewalks of a city and a high intensity of illumination is not desirable. Obstacles must be made sufficiently plain to prevent passengers from stumbling, but on the other hand, the public prefers to take full advantage of moonlight scenes on the waters and this is impossible when the local illumination is intense. Recently built ocean steamships provide



FIG. 12

View of Enclosed Deck Utilized as a Smoking and Lounge Room, Illuminated by 40-watt MAZDA Lamps in Shallow Type Opalescent Glass Semi-indirect Bowls. A short sturdy three legged rigid fixture is employed. Outlets are spaced regularly on five-foot centers

recreation spaces on the open decks in the form of "lounge gardens." In such cases the illumination must be sufficient to allow of dancing, reading, etc., as indicated in Fig. 12.

The systems of deck illumination vary but little. Vapor-proof fixtures are placed overhead at distances varying from 15 to 20 ft. Clear outer globes are most common with clear MAZDA lamps as the source of light.

Lake and River Boats

These vessels, with the exception of ferryboats and tugs, as regards illumination, are very similar to ocean liners. In the con-

struction, however, there are a few variations. The overhead spaces are generally higher and the passageways broader. Such rooms as swimming pools are omitted, and better facilities for sightseeing provided. The illumination requirements throughout the interior of these vessels are similar to those on the larger vessels and the systems employed are equally elaborate. The size of the vessels permits a wider use of daylight in all sections. Ferryboats are illuminated after the style of train and trolley lighting. They cater to the business public and are not intended for recreation. The business man is usually absorbed in his newspaper while on a ferry, hence these boats are lighted with that in view. The interiors of the main deck are generally of a dark finish with 12 to



FIG. 13

Night View of Promenade Deck on Large Ocean Liner Illuminated by 25-watt Clear MAZDA Lamps in Vapor-proof Enclosed Fittings, Staggered Spacing on Nine-foot Centers. Deck beams prevent possibility of mechanical injury

15 ft. headroom, but the upper deck, while employing a similar finish, seldom has more than 8 ft. headroom.

Modern practice employs one row of brackets along each side of the passenger compartments. These units consist of a simple brass bracket with decorative husk or an opalescent or prismatic glass shade. Clear MAZDA lamps are used with a spacing distance of from 3 to 5 ft. This system is not to be recommended. It is not efficient and gives a glaring result.

A few of the more recently built ferryboats employ a system of overhead illumination, the units being placed close to the ceiling and equipped with prismatic glass or opalescent glass reflectors of

the deep bowl type as shown in Fig. 14. It has been proven by experiment that this system is much more efficient and gives better results than that described in the preceding paragraph. The initial cost of installation is less than half of that for side bracket installation and the cost of renewal and current consumption is a minimum. The driveway on a ferryboat calls for an approximation of street lighting, the present practice—vapor-proof fixtures with clear outer globes and clear lamps of from 15 to 40 watts—being rather poor. An overhead system of high intensity units in vapor-proof fixtures equipped with enamel steel reflectors gives much better results and is to be recommended.

The section of this article relative to engine room lighting covers almost the entire field of tug lighting. Deck spaces are limited and few lights are necessary. However, vapor-proof fixtures employing clear MAZDA lamps and outer globes so placed as to be invisible from passing vessels, provide sufficient illumination to allow the crew to move around at will with comparative ease.

Special Fixtures

There are a large number of special fixtures on board ship. These are used as aids in navigation. They are as follows: Main masthead, port, starboard and stern light fixtures; also fixtures for lighting docking and engine telegraph, steering and standard compasses, signal flash lanterns, etc. These are the most important lights on the ship from a navigating point of view, but are least conspicuous to the casual observer. They are of special design and are built for durability and service, since they are required by law, and in view of the limited space here available it is unnecessary to discuss them in detail.

Battleship lighting has been very well taken care of by the Government, the latter fully realizing the importance of good illumination both as regards the handling of vessels and the comfort and efficiency of the crew. However, there are several points worthy of note here.

The voltage on battleships is generally 220 volts, three-wire, whereas on merchant ships 110-volt, two-wire systems are used.

There are three different kinds of lighting: (1) General illumination for cruising conditions; (2) white light for battle purposes; (3) blue light for battle purposes when it is necessary to conceal operations. In some cases, three separate circuits are provided for these purposes, but in other cases there are two general circuits provided, known as the battle circuit and the lighting

circuit. The battle circuit includes only those lights which are absolutely necessary in battle, while the lighting circuit includes those which may be dispersed with in action. An auxiliary circuit is supplied from a battery of storage cells so that in case of disabled generators total darkness will not result. This circuit has a voltage of 20 volts.

The fixtures on battleships vary somewhat, but a general idea of those in use may be given by describing those found in a particular ship. On the ship in question, there are about 3000 fixtures



FIG. 14

Night View of a Cabin of a Ferryboat Lighted by 100-watt Bowl Frosted MAZDA Lamps in Prismatic Glass Reflectors. This combination provides a high intensity of evenly distributed light in an efficient manner

of the vapor-proof type. The outer globes are flanged and held in place by guards instead of being screwed into the base. In the magazine and shell rooms, specially guarded fixtures containing two lamp sockets are installed, the lamps being connected to different circuits to guard against total darkness in case one circuit fails. A special fixture containing a 250-watt MAZDA lamp provided with reflector is arranged for portable connection in the engine, boiler and dynamo rooms. The composition of the metallic part of all fixtures is brass or bronze and is so constructed as to withstand all shocks from gunfire, etc.

On the whole, battleships are well lighted and merchant shipping companies could benefit much by adopting some of the lighting methods practiced by the navy. This applies specially to the illumination in the working areas of merchant ships.

Conclusion

The foregoing article has been confined to the more important phases of ship lighting in general. It is obviously impossible to take such a broad subject up in detail in such a limited space. However, general practice has been pointed out and some suggestions made. These suggestions are made after many inspections and investigations, but it must be thoroughly understood that the best results can only be obtained by thorough familiarity with the actual conditions under which an installation is to operate. This can best be accomplished by whole-hearted co-operation between the shipping companies themselves and the manufacturers of electric lighting equipment. Great improvement has recently taken place in ship lighting but there is still opportunity for many more improvements, especially with regard to freight decks, engine and boiler rooms, crew's quarters, galleys, stores, etc. Better lighting in these sections while costing comparatively little, both for initial outlay and maintenance, would be of great benefit to the crews and shipping companies in general.

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